Materials Engineering Branch

TIP*

No. 074 Polyurethane Paints for Flight Hardware

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Aeroglaze Z306, a flat black polyurethane paint, manufactured by the Hughson Chemical Company has been used successfully on flight hardware (metallic as well as non-metallic) for a number of years. The paint normally requires a room temperature cure but usually requires a post-cure bake to reduce the %TML to an acceptable level. It provides excellent adhesion to a variety of surfaces, in many cases without a primer[1]. Test results, however, show that the best adhesion to most surfaces is usually realized when Z306 is applied over the recommended primer.

TIP 057 discusses typical substrate materials that have been painted with Aeroglaze Z306 and flown on space flight hardware with good results. Since then, Aeroglaze Z306 has also been applied to bare Kapton (polyimide) plastic film as well as to aluminized Kapton with excellent results. Laboratory tests show that the adhesion of the Z306 on both bare and aluminized Kapton after temperature cycling from -125°C to +60°C in vacuum (10^{-6} torr) and following severe wrinkling of the painted Kapton, maintained integrity.

The salient features of Aeroglaze Z306 are:

- low cost
- easy to apply by spraying or brushing
- requires only a room-temperature cure
- excellent adhesion to a variety of substrate materials over a wide temperature range
- %CVCM is usually acceptable but %TML usually requires a post-cure bake to be less than 1.00%
- good flexibility
- durable under normal handling
- relatively easy to clean

[1] The two most often used primers are Hughson 9924 (two part) wash primer and Hughson AP131 (one part) air curing silane-based primer. The paint/primer combinations that offer the best outgassing performance are the Z306 or A276 with the AP131 primer. Although AP131 is preferred from an outgassing perspective, it is not the best choice for all substrate materials.

The optical properties of the cured film are:

α_s (solar absorptance) = 0.94 to 0.96 and

ε_n (emittance, normal) = 0.91

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Aeroglaze A276, a high gloss white polyurethane paint, manufactured by the Hughson Chemical Company, has also been widely used on space flight hardware with success. The paint has been applied to metallic surfaces as well as to Kapton with both primed and unprimed surfaces. Again, as with the black Z306 described above, the Aeroglaze A276 adhesion to most substrate materials has been shown to be excellent over a wide temperature range in vacuum (10^{-6} torr).

The salient features of Aeroglaze A276 are:

- low cost compared to other acceptable white paints
- considerably lower outgassing than most other white paints
- easy to apply by spraying or brushing
- excellent adhesion to a variety of substrate materials over a wide temperature range
- good flexibility
- durable under normal handling
- easy to clean

The optical properties of the cured film are:

$\alpha_s = 0.25$ and $\varepsilon_n = 0.88$

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It is important to note that Aeroglaze A276 has poor ultraviolet stability. All samples tested by us showed an increase of absorptance from 55 to 65% after an exposure of 1,036 equivalent solar hours.